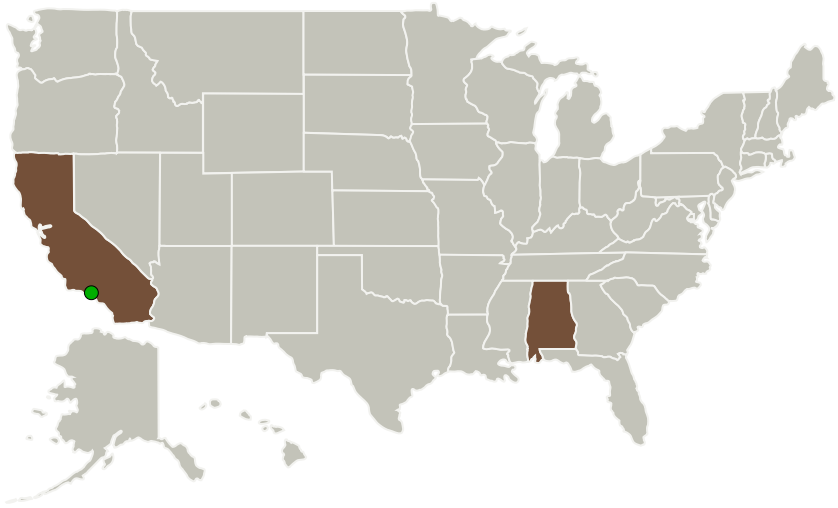
A Miniaturized Sensor for Microbial Monitoring of Spacecraft Water Environment, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

Accurate real-time microbial monitoring of water environment is of paramount importance to crew health as well as to ensure proper functioning and control of the life support system during space exploration. The existing methods are time-consuming and labor-intensive, and the devices used are bulky, consumable-hungry, and ill-suited for spacecraft deployment. We propose to develop and demonstrate a novel, fully automated, microfluidics-based sensor for detection and identification of microbes in water. The final product will be compact, accurate, fully integrated and automated, power-effective, and fieldable in research and space environments. The program objectives will be accomplished via several innovations: (a) a milli-fluidic microbe preconcentrator to improve detection sensitivity; (b) CFDRC's proprietary dielectrophoresis technology will be adapted to develop a dielectrophoretic focuser for differentiation and separation of target microbes from complex sample matrices; and (c) microfluidic impedance spectroscopy-based cytometry to enable label-free detection and near reagent-free operation. In Phase I, we will demonstrate all critical components to establish proof-of-concept of the proposed technology. Phase II efforts will focus along two lines. First, component design optimization will be carried out with fabrication enhancements and extended testing and characterization for technology validation. Second, an integrated microfluidic cartridge and instrumentation capable of automated operation (sample processing and detection) will be developed. The prototype instrument will be demonstrated in both terrestrial and hypogravity environments (in collaboration with NASA researchers/facilities).

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
CFD Research Corporation	Lead Organization	Industry	Huntsville, Alabama
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
Alabama	California

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140083)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

CFD Research Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Yi Wang

Co-Investigator:

Yi Wang

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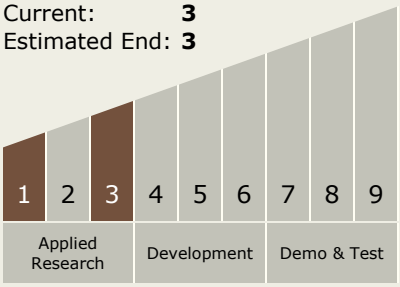
Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.4 Environmental Monitoring, Safety, and Emergency Response
    - TX06.4.1 Sensors: Air, Water, Microbial, and Acoustic

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System